



PATENT

UNITED STATES PATENT AND TRADEMARK OFFICE

Confirmation No.: 8338

Application No.: 10/702,419

Applicant: HRYN, et al.

Filing Date: November 5, 2003

Application: PROCESS FOR ELECTROLYTIC PRODUCTION OF ALUMINUM

Examiner: Michael P. Alexander

Art Unit: 1742

Atty Docket No.: 0003-01398

**CERTIFICATE OF MAILING**

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**37 C.F.R. 1.132 Affidavit of Inventor**  
**John N. Hrym**

I, John N. Hrym, declare that I am an inventor in the above-identified matter and I further state the following:

1. I received my B.A.Sc. Degree in Metallurgy and Materials Science from the University of Toronto, my M.A.Sc. Degree in Metallurgy and Materials Science from the University of Toronto and my Ph.D. in Metallurgy and Materials Science from the University of Toronto.

2. Since 1993, I have been a research engineer at Argonne National Laboratory, and since 1994 my primary research emphasis has been on aluminum related technologies.

3. Prior to my employ at Argonne National Laboratory, I was a post-doctoral fellow at Massachusetts Institute of Technology (MIT) from 1991 to 1992 where I began my work on aluminum electrolysis.

4. I have published approximately 10 papers in the area of aluminum processing. Representative publications include Yang, J., Hryna, J. N., Davis, B.R., Roy, A., Krumdick, G. K., Pomykala, J. A., Jr., "New opportunities for aluminum electrolysis with metal anodes in a low temperature electrolyte system," in Light Metals 2004, The Minerals Metals and Materials Society, Warrendale, Penn, (2004) pp. 321-326 and Yang, J., Graczyk, J. G., Hryna, J. N., "Alumina solubility in a KF-AlF<sub>3</sub>-based low temperature electrolyte system," in Light Metals 2006, The Minerals Metals and Materials Society, Warrendale, Penn, (2006).

5. I have received numerous patents, (including patent numbers: 6,485,541 B1, 6,083,362, 6,461,491 B1, 6,375,813 B1) for research related to aluminum processing. Also, I was awarded the Federal Laboratory Consortium Technology Transfer Award for research related to electrodialysis processing.

6. I have read the July 28, 2005 Official Action. It is my understanding that my invention is being rejected by U.S. Patent No. 6,379,512 B1 issued to Brown. Brown does not disclose my invention, and in fact, teaches the opposite of what my electrolyte embodies.

7. Brown describes 19 tests to produce aluminum and these tests espouse high concentrations of NaF. This is contrary to my invented electrolyte. For example, of the 19 tests in Brown, 18 are based on sodium-containing electrolyte (either NaF-AlF<sub>3</sub> or NaF-KF-AlF<sub>3</sub>) whereby NaF is present in a mol% amount of 56 mol %. In the only electrolyte in Brown not containing sodium (see run 16, column 14: lines 29-38), a low efficiency yield of 33% is obtained. Anything below 50% is a bad result at this experimental scale. Indeed, Brown's other efficiency readings range from 43% to 89%.

8. Brown's electrolyte has an alumina solubility of 1-2 wt%. This is insufficient to perform aluminum electrolysis in an economical way. Brown knows this and so he focuses on his 'slurry-cell' in which solid alumina is entrained in the electrolyte. Brown does not realize the benefit of using a low sodium electrolyte to increase alumina solubility. Rather, he acquiesces to a 1-2 percent alumina solubility ceiling and relies instead on a complicated mixture of transition metal to make the electrolyte. It is interesting to note that all of Brown's claims require the transition metal mixture recited in claim 1b.

9. My invented electrolyte enhances the solubility of alumina. Therefore, the conditions for aluminum production greatly improve. Furthermore, as the composition of the electrolyte becomes richer in KF, the solubility of alumina greatly increases to about 6 wt%. As a result, my electrolyte composition is much different from Brown in '512.

10. In '512, Brown describes the addition of Cu, Fe, Co, Mo and Ni components to the electrolyte. It is Brown's addition of these metal components to his electrolyte that causes the composition to remain relatively constant. My electrolyte does not need the addition of these metal components to maintain the concentration. Rather, it is an inherent feature of my composition that renders a relatively constant concentration of electrolyte components, as recited in claim 4. The electrolyte composition in the instant invention is kept constant based on the major components (KF-AlF<sub>3</sub>) and not the addition of minor metal elements as discussed in '512.

11. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application of any patent issuing thereon.

Sincerely,

Jan 27, 2006  
Date

  
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John N. Hrynn, co-inventor